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Effects of probiotic Bactocell on growth and survival parameters of benni fish (*Mesopotamichthys sharpeyi*) fingerlings

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Abstract. The rapid growth of aquaculture in recent times has been exemplified by increases in growth, survival and nutrition efficiency through feeding, and these are among important objectives in the aquaculture industry. The use of probiotics is one effective way to improve the diet of fishes. The aim of this study was to investigate the effects of probiotic Bactocell on growth parameters and survival of benni fish (*Mesopotamichthys sharpeyi*) fingerlings. Two hundred and forty (240) fish with the similar weight were divided into the four experimental groups (0, 0.1, 0.2 and 0.3 grams of probiotic Bactocell per kg of diet). Fish were fed twice per day up to satiation for 8-week period. Fish were weighed at the end of trial period. The results showed that probiotic Bactocell had positive effect on some growth parameters of benni. At the end of trial period, the experimental groups treated by probiotic showed higher final weights compared to control but not statistically significant ($p > 0.05$). Percent weight gain and specific growth rate in the second treatment (0.2 g probiotic Bactocell per kg of diet) significantly increased compared to control ($p < 0.05$). The feed conversion ratio decreased in treated groups (0.1, 0.2 and 0.3 g probiotic bactocell per kg of diet) compared to control but not statistically significant ($p > 0.05$). Also, the survival rate showed no noticeable effects ($p > 0.05$). It is proposed that probiotic Bactocell (0.2 g per kg of diet) when incorporated in diet can improve the growth and nutrition efficiency of benni fish fingerlings.
Key Words: aquaculture, feeding, weight, nutrition efficiency.

Introduction. Probiotics are one of the positive achievements of the researchers, which reduce the risk of disease, improve feed conversion ratio and usage of probiotics as a growth promoter have no tissue residual and do not cause bacterial resistance unlike antibiotics (Rastad 2008). Probiotics, although beneficial bacteria in the digestive tract, could be supplemented in diet with aim to positive affect the gastrointestinal-colony friendly flora so as to overcome the population of harmful microbes, which in turn enables microbial balance in the tract (Afshar Mazandaran & Rajab 2001; Fuller 1992; Jones & Ricke 2003).

Competition for nutrients, colonization places as well as the creation of disadvantaged environment for harmful microbes are among very important activities that the use of probiotics activates. As a consequence, the final result is to cause the body to grow effectively, to improve the feed conversion ratio, to reduce the bad types of cholesterol, nitrogen fixation as well as the toxic effects of ammonia (Batal & Parsons 2002; Denli et al 2003; Jin et al 1998; Kalavathy et al 2003).

Specifically, *Lactobacillus* spp. is mainly used in the production of probiotics. Moreover, *Streptococcus*, fungi and yeasts are also used (Fuller 1992). The remarkable thing about probiotics is the appropriateness of condition in the digestive tract as a medium for proper growth, reproduction and the colonization of these microorganisms

(Roy et al 2002; Shashidhara & Deregowda 2003). It is widely understood that probiotics function as microbial supplements to improve balance of intestinal microbial load of the host, for example, human. Today, a number of commercially bacterial compounds are available. They also perform the function of nutritional supplements, which can be included in fishery diets in the aquaculture farms.

Apart from the use of specific above-mentioned bacteria, some researchers have also adapted its commercially available by-products. Among others, Bactocell remain among by-product probiotics of lactic acid bacteria. Bactocell has been long reported and is composed of 1×10^{10} cfu g^{-1} bacteria strain, *Pediococcus acidilactici* (Fuller 1989). This product is believed to increase the immunity and survival against diseases as well as environmental stresses by reproduction. It is also believed to increase the number of microbial load in the digestive system of host as it sticks onto the intestinal wall, yet increasing its growth and production in somewhat shorter time with reduced mortalities (Gatesoupe et al 1997).

Benni fish (*Mesopotamichthys sharpeyi* Günther, 1874) of carp family are among commercial fish of Khuzestan wetlands,, Iran and have a great importance due to its relatively promising growth, tolerance to adverse environmental conditions as well as high economic value even though its distribution around the globe remains somewhat limited (Coad 1996). Specifically, the Hor-Alazim wetland is the main habitat of benni within the Khuzestan province. Benni fish has been reported in other places such as Syria, Iraq, Turkey, Iran and Egypt (Hashem & El-agamy 1977).

In this study, the effects of probiotic Bactocell on survival and growth parameters of benni were studied. Specifically, the reason to study its effects on survival and growth was to establish how promising this probiotic would likely be as it is effectively incorporated into its diet.

Material and Method. The experiment was carried out between August and September 2014 at the Fish Nutrition Unit, Zist Pazhohan Arvand Company (Khorramshahr, Khouzestan, Iran).

Diet preparation. In order to prepare the diet, ingredients were weighted and among others, the vitamin compounds, minerals and other additives thoroughly mixed together were then added onto main ingredients, after which the compounds were mixed with fish oil. The combination was mixed for 30 min, then water added to about 20%, mixing then continued for another 15 minutes. Thereafter, the prepared diet was transferred to the grinder. In this experiment, according to specified treatments, Bactocell was added in 3 levels: 0.1, 0.2 and 0.3 g kg^{-1} to the control diet. Control group was with no Bactocell.

Experimental design and growth parameters. Fingerlings were obtained from a local farm (Khuzestan province, Iran). The fish were acclimated to laboratory condition for 2 weeks before starting the feeding trial. Fingerlings are randomly distributed in the aquarium cabinets of 150 L volume and 20 fish per tank. Group of fish with three replicates were fed manually at satiation in two times per day (9 and 16 hours) and for 8 weeks. Photo-period was based on the natural system of light and darkness. Fish were weighted and growth and survival was calculated at the beginning and end of the trial.

Statistical analysis. This study was performed randomly. Data was subject to normality test via Shapiro-Wilk test. Significant differences between treatments at different levels ($p < 0.05$) were examined using ANOVA (One-way ANOVA). Mean differences were resolved by Duncan test. Analysis of all the data was conducted using SPSS 19 software.

Results. At the end of eighth week, it was found that even though no significant differences ($p > 0.05$) appeared in the final weight between the groups, the final weight of the treated groups appeared enhanced compared to the control. However, weight gain (WG) percent and specific growth rate (SGR) in the second treatment (0.2 g Bactocell per kg of diet) showed significant increases compared with the control ($p < 0.05$) (Table 1). The feed conversion ratio (FCR) showed no differences between groups ($p > 0.05$),

although was lower in the treated groups appeared comparable to control. The survival rate (SR) showed no significant differences between groups ($p > 0.05$).

Table 1

Survival and growth parameters of Benni fish fingerlings fed the experimental diets for 8 weeks

Parameters	*Diets (g kg^{-1})*			
	Control	*0. 1*	*0. 2*	*0. 3*
Initial average weight (g fish^{-1})	9.23 ± 0.14^{ns}	9.22 ± 0.13	9.22 ± 0.17	9.23 ± 0.18
Final average weight (g fish $^{-1}$)	14.13 ± 0.35^{ns}	14.30 ± 0.26	14.40 ± 0.31	14.19 ± 0.33
[1]Weight gain (g fish^{-1})	4.90 ± 0.20^{ns}	5.07 ± 0.13	5.18 ± 0.17	4.96 ± 0.15
[2]Weight gain percent	53.06 ± 1.42^{a}	54.93 ± 0.72^{ab}	56.23 ± 1.45^{b}	53.76 ± 0.60^{a}
[3]Specific growth rate[1] (%)	0.75 ± 0.015^{a}	0.78 ± 0.011^{bc}	0.79 ± 0.015^{c}	0.77 ± 0.010^{ab}
[4]Food conversion ratio	2.53 ± 0.45^{ns}	2.29 ± 0.16	2.25 ± 0.12	2.33 ± 0.57
[5]Survival	93.33 ± 5.77^{ns}	96.66 ± 2.88	95.00 ± 5.00	95.00 ± 8.66

Values (means ± SE of three replication) in the same row not sharing a common superscript are significantly different ($p < 0.05$); ns = not significant ($p > 0.05$); [1]Weight gain = final weight-initial weight; [2]Weight gain percent = [(final weight-initial weight)/initial weight] ×100; [3]Specific growth rate (%) = [ln (final fish wt.) - ln (initial fish wt.)] × 100/days of feeding; [4]Food conversion ratio = weight gain/feed intake; [5]Survival = (final fish number/initial fish number) × 100.

Discussion. The probiotic Bactocell appears to be positive candidate on the studied growth parameters and feed efficiency of benni fish fingerlings. Hoseini et al (2013) studied the effects of Bactocell on growth parameters of rainbow trout (*Oncorhynchus mykiss*), and reported that probiotic Bactocell increased the WG and SGR in treated groups compared to control.

Baghaei-Bahamberi et al (2013) also examined the effects of Bactocell on biological factors of great sturgeon juveniles (*Huso huso*), and from their results, the mortality rate and FCR showed lower but not at SGR and final weight that showed higher in the experimental treatments compared to control. Modabberi et al (2014) also examined the effect of different doses of probiotic Bactocell in the diet of rainbow trout on growth parameters and bacterial flora. These authors found that the probiotic Bactocell is promising candidate to affect the WG and capable of improving the efficacy of bacterial flora of rainbow trout.

Ghobadi et al (2015) also examined the effects of probiotic Bactocell on some growth indices, survival and body composition of common carp (*Cyprinus carpio*) fingerlings. It was shown that incorporating probiotics to fish groups affected the growth and nutrition parameters such as WG, SGR, protein efficiency, FCR and SR at a better level compared to control.

In the present work, it was showed that no significant difference existed at SR between the studied treatments. Given that the SR appeared above 90%, there is high chance to attribute such occurrence to the available good promising weather conditions. Besides, other researchers also did not find significant differences in the use of probiotics for the reason that SR increasingly appeared at their researches (Farzanfar 2006)

Probiotic Bactocell stimulates the appetite by producing vitamins, detoxification from the diet, break down of indigestible substances, providing better nutrition condition for fish, as well as reducing the incidence of spinal defects (Irianto & Austin 2002). The most important reason is probably associated with the production of enzymes by bacteria, *P. acidilactici* in probiotic. On the other hand, Bactocell PA 10 MD is able to break down proteins and carbohydrates. In addition, the ability to produce some vitamins can be another factor for better metabolism of diet in these organisms (EFSA 2008).

Conclusions. The use of Bactocell as dietary supplement notably increases growth and nutritional parameters in the benni fish fingerlings. The optimal level could be the 0.2 grams of probiotic Bactocell per kg of diet. In this direction, incorporating 0.2 grams of Bactocell per kg diet stands the chance to improve the growth and nutritional performance of benni fish fingerlings.

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